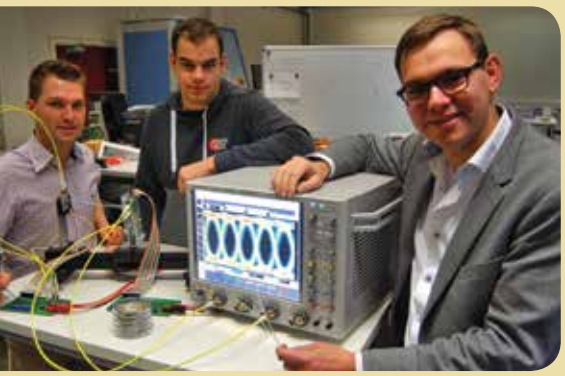
KU Leuven demonstrates a 120GHz Gbps plastic fiber link at ISSCC 2015

In February 2015, researchers from the KU Leuven ESAT-MICAS research group have presented and demonstrated a complete plastic fiber link at ISSCC (International Solid-State Circuits Conference). ISSCC is the annual industry's premier venue for presentations on



new developments in the integrated-circuit industry. The link consists of a 120GHz transmitter with on-chip dipole antenna, a Teflon tube that acts as a dielectric waveguide, and a 120GHz receiver with bondwire antenna. Over this cheap and reliable link, data rates of up to 13Gbps and distances of up to 7 meters have been achieved.

"This demonstrator is the result of several years of research", commented Prof. Patrick Reynaert. *"We started to explore mm-wave CMOS circuits operating above 100GHz already in 2008, when most other groups were focusing on 60GHz. Going to higher frequencies allows higher data-rates. But the communication distance reduces accordingly. That is why beamforming is so important for mm-wave communication. But instead of using a directive antenna, we use a directive channel. It turns out that cheap plastics are excellent directive channels for mm-wave signals. This enables the use of mm-wave frequencies for Gbps data communication over meters distances. Furthermore, we don't need accurate mechanical alignment as needed for optical. And we are still robust against EMI."*

Niels Van Thienen, one of the Ph.D. students working on this topic, continues: *"It was quite a challenge to bring all the pieces of the puzzle together. After all, what we demonstrate is not just a 120GHz chip. What we show here is a complete link, including the chips, the coupling between the chips and the plastic fiber, and the plastic fiber itself. Our design of the connector between the chips and the fiber proves robustness and easy handling. Misalignment up to 1mm can be tolerated. We have chosen a carrier frequency of 120GHz as this allows us to make sharp bends in the plastic channel, as required in an automotive or for USB connectivity."*

"The chips are implemented in 40nm CMOS, and everything is integrated on it" says Wouter Volkaerts, who designed the 120GHz transceiver chips. *"We make use of FSK modulation as this allows a very simple implementation, but yet broadband operation. The high carrier frequency features a small relative bandwidth and thus low dispersion. Therefore, the energy per bit per distance is excellent and even better than most copper wireline interconnects. Of course, for very short or very long distances, copper or optical might still be better. But there is a sweet spot in between copper wireline and optical, and that is exactly what we targeted with this research and demonstrate with this setup"*.

Prof Patrick Reynaert: *"Of course, research never stops, so now we want to go for full duplex, explore the use of THz frequencies and further improve the overall link. There is a clear interest from industry in this field so we are looking forward to push this research demonstrator into real products"* ■

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"Our increasing number of customers both inside and outside of the Satcom industry confirms that our manufacturing site is already extremely effective," said Danny De Smet, responsible for business development at Newtec's MCC. *"This is without a doubt the result of our continuous improvement culture and competence building and this investment will further strengthen that. Often we are challenged from a technological perspective but by being proactive, flexible and reliable we can add significant value for our customers and partners."* ■

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